Catastrophizing-a prognostic factor for outcome in patients with low back pain: a systematic review

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Abstract: BACKGROUND CONTEXT Psychological factors including catastrophizing thoughts are believed to influence the development of chronic low back pain (LBP). PURPOSE To assess the prognostic importance of catastrophizing as a coping strategy in patients with LBP. STUDY DESIGN This is a systematic review. PATIENT SAMPLE This study included patients with LBP. OUTCOME MEASURES Work-related outcomes and perceived measures including return to work, pain, and disability. METHODS In September 2012, the following databases were searched: BIOSIS, CINAHL, Cochrane Library, Embase, OTSeeker, PeDRO, PsycInfo, Medline, Scopus, and Web of Science. To ensure completeness of the search, a hand search and a search of bibliographies were conducted and all relevant references included. All observational studies investigating the prognostic value of catastrophizing in patients with LBP were eligible. Included were studies with 100 and more patients and follow-up of at least 3 months. Excluded were studies with poor methodological quality, short follow-up duration, and small sample size. RESULTS A total of 1,473 references were retrieved, and 706 references remained after the removal of duplicates. For 77 references, the full text was assessed and 19 publications based on 16 studies were included. Of four studies that investigated work-related outcomes, two found catastrophizing to be associated with work status. Most studies that investigated self-reported outcome measures (n=8, 66%) found catastrophizing to be associated with pain and disability at follow-up in acute, subacute, and chronic LBP patients. In most studies that applied cutoff values, patients identified as high catastrophizers experienced a worse outcome compared with low catastrophizers (n=5, 83%). CONCLUSIONS There is some evidence that catastrophizing as a coping strategy might lead to delayed recovery. The influence of catastrophizing in patients with LBP is not fully established and should be further investigated. Of particular importance is the establishment of cutoff levels for identifying patients at risk.

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Catastrophizing - A Prognostic Factor for Outcome in Patients with Low Back Pain – A Systematic Review

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Abstract

Background Context: Psychological factors including catastrophizing thoughts are believed to influence the development of chronic low back pain.

Purpose: To assess the prognostic importance of catastrophizing as a coping strategy in patients with low back pain.

Study Design: Systematic Review

Patient Sample: Patients with low back pain.

Outcome Measures: Work related outcomes and perceived measures including return to work, pain and disability.

Methods: In September 2012, the following databases were searched: BIOSIS, CINAHL, Cochrane Library, Embase, OTSeeker, PeDRO, PsycInfo, Medline, Scopus, and Web of Science. To ensure completeness of the search, a hand search and a search of bibliographies was conducted and all relevant references included. All observational studies investigating the prognostic value of catastrophizing in patients with low back pain were eligible. Included were studies with 100 and more patients and follow-up of at least three months. Excluded were studies with poor methodological quality, short follow-up duration, and small sample size. This study was not funded and the authors have no conflict of interest to declare.

Results: 1473 references were retrieved, and 706 references remained after the removal of duplicates. For 77 references, the full text was assessed and 19 publications based on 16 studies were included. Of four studies that investigated work-related outcomes, two found catastrophizing to be associated with work status. Most studies that investigated self-reported outcome measures (n= 8, 66%) found catastrophizing to be associated with pain and disability at follow-up in acute, subacute, and chronic low back pain patients. In most studies that applied cut-off values, patients identified as high catastrophizers experienced a worse outcome compared to low catastrophizers (n=5, 83%).

Table 1: Baseline Characteristics

Acute Low Back Pain

ID	Study	Design and SIGN	Setting	Population	Diagnostic criteria	Disease duration: mean days (SD)	Power analysis	n (female)	Drop-out: n (%)	Age (years) mean (SD)	follow-up (days)
20A	Jellema et al. 2007 [28]	Prospective cohort after a cluster RCT, SIGN +	GP select 10 consecutive patients who consulted for a new episode of low back pain, Netherlands	RCT UC vs. MIS. 13.8% radiating pain below the knee, 13.8% first episode	NSLBP with pain referral +/- below the knee	Median 12 (IQR 6-21)	N.R.	314 (149)	16 (5.1)	42.7 (11.6)	360
20B	van der Windt et al., 2007 [29]	Same as Jellema 2007, only UC group	Patients with LBP consulting one of 32 GPs, Netherlands	Only UC group: 14.6% pain radiating below knee, in 36.3% musculoskeletal pain elsewhere. 18.8% first episode	NSLBP + SLBP	Median 14 (IQR 7-21)	N.R.	171 (81)	7 (4)	42 (12)	90
40	Verbunt et al., 2008 [48]	Prospective, SIGN +	General Practitioner and advertisement in a local newspaper, Netherlands	Highly fearful patients (TSK > 42) were excluded from participation	NSLBP between scapulae and gluteal folds	< 7d: 146, 8-14d: 44, > 15d: 32	N.R.	282 (129)	56 (20)	43 (10.3)	360
53	Hancock et al. 2009	Secondary Analysis of RCT, SIGN ++	GP setting, Sydney, Australia	Patients consulting GP for pain between 12th rib and buttock crease with moderate pain and disability	NSLBP	9.13 (9.31)	240	239 (105)	1 (0)	40.7	90

Acute Low Back Pain

ID	Study	Question-naire	MA?	Criteria for inclusion MA	Cut-off used	Base-line mean	Measure reported	Value (95%-CI)	Outcome	Prognostic?
20 A	Jellema et al. 2007	CSQ	Yes	p <0.2	No	10.8 (6.7)	OR	1.04 (0.99; 1.09), p=0.09	Unfavorable outcome	Patients with high catastrophizing were more likely to have a unfavorable outcome
20 B	van der Windt et al., 2007	CSQ	Yes	p <0.1	Medium: 20-40	Standardized mean 30.6 (not standardized mean 11.2, SD 6.9)	OR	2 (0.93, 4.3)	Persisting Symptoms (7-point likert scale)	Patients with high Catastrophizing (CSQ >40) are more likely to have persistent symptoms than patients with lower values.
					High >40			2.45 (1.09, 5.5)		
					Medium: 20- 40			2.27 (0.66, 7.8)	<30% improvement of Disability (RMQ)	There is an interaction of catastrophizing with the likelihood to improve RMQ but it was statistically not significant
					High: > 40			3.31 (0.93, 44.9)		
40	Verbunt et al., 2008	PCS	Yes	All variables	No	14.4	OR	1.05 (1.02, 1.08), p=0.001	Prolonged bed rest (>4 days)	Catastrophizing thinking was associated with prolonged bed rest
	Hancock et al. 2009 [44]	PRSS	Yes	P <0.1	Low ≤1.78)	1.85 (0.94)	HR	N.R.	Days without pain	Catastrophizing univariate associated but not in the multivariate model. In the multivariate model remained baseline pain, duration of the current episode, number of previous episodes

	All		Acute		Acute to subacute		Chronic		Acute to chronic	
Prognostic: + = yes	+	-	+	-	+	-	+	-	+	-
Publications: n=12 (100%)	12 (63%)	7 (37%)	3 (15%)	1 (6%)	3 (15%)	4 (22%)	3 (15%)	1 (6%)	3 (15%)	1 (6%)
Prognostic Domain: mean (SD)	7.6 (1.8)	9.1 (2.9)	8.3 (1.5)	6	6.2 (1.5)	10.8 (2.5)	8.7 (2.1)	9	7.0 (1.7)	6
Psychological Domains: mean (SD)	2.7 (1.3)	2.1 (0.9	3.0 (1.7	1	3.0 (1.7)	2.5 (0.6)	3.0 (1.0)	1	2.3 (1.5)	3
Patients investigated: mean (SD)	521.2 (581)	676 (731)	256 (75)	239	734 (962)	685 (799)	321 (300)	163	680 (648)	1591
Age: mean (SD)	44 (4.7)	41 (4.5)	42.6 (0.5)	40.7	39.4 (5.7)	43 (3.8)	43.4 (3.8)	44	49.7 (3.0)	43.9
Follow-up: mean SD	278 (112)	576 (892)	270 (156)	90	300 (104)	247 (135?	270 (90)	2160	271 (157)	180

	All		Acute		Acute to subacute		Chronic		Acute to chronic	
Prognostic: + = yes	+	-	+	-	+	-	+	-	+	-
PCS (0-52): mean (SD)	20.1 (8.5)	18.1 (9.9)	14.4	-	N.R. / 16.12	N.R. / 11.2 / N.R.	-	25.1	High 29.9, Low 15	-
Sub-scales: Rumification / Magnification / Helplessness: median						10/5/11				
Cut-off used				-	Short PCS Low <2, High 3-4	Short PCS Low <2, High 3-4	High ≥30	-	High >23	
CSQ (0-36): mean (SD)	12.3 (2.3)	10	10.8 / 11.2		N.R.	-	N.R./N.R./ Short (0-2: 2)	-	15 / N.R.	10
Cut-off used			Medium 20-40, High 40-100						Low ≤8, 9-15, 16-20, 16-20, ≥21	
PRSS (0-5): mean (SD)	1.85		-	1.85 (0.94)	-	-	-	-	-	-
Cut-off used			-	1.85	-	-	-	-	-	-

Acute to Sub-Acute Low Back Pain

ID	Study	Question-naire	MA?	Criteria for inclusion MA	Cut-off used	Base-line mean	Measure reported	Value (95%-CI)	Outcome	Prognostic?
18 A	Grotle et al., 2010	CSQ	Yes	p <0.1	No	N.R.	Beta	1.68 (0.01, 3.36), p=0.051	Disability due to LBP (RMQ)	Patients with catastrophizing thoughts expressed more disability at follow-up
19	Hiebert et al. 2012	PCS	Yes	p <0.15	No	11.1	PR (Prevalence Ratio) univariate	1.01 (0.98, 1.04)	Work duty status (not at full duty) at 4 weeks	Catastrophizing thoughts did not influence work status at follow-up of 4 and 12 weeks
							PR univariate	1.01 (0.95, 1.07)	Work status at 12 weeks	
14 A	Turner et al. 2008 [33]	PCS 3 questions,	Yes		Low >1-<2		OR	1.05 (0.53; 2.09)	Not RTW at one year	Bivariate mental health, FAB and catastrophizing were strong predictors of work disability. Multivariate they were only statistically significant when RMQ was excluded from the analysis.
					Moderate 2-<3		OR	1.06 (0.58; 1.93)		
					High 3-4			1.33 (0.71; 2.48)		
14 B	Franklin et al., 2009	PCS (3-questions)	Yes	All variables included	Low: <2	N.R.	OR	1 (Reference)	Long term opioid use	Reference
					Moderate: 2-<3			0.98 (0.51, 1.89)		Moderate Catastrophizing non-prognostic
					High: 3-4			2.11 (1.11, 4.02)		High Catastrophizing associated with long term opioid use

37 A	Valencia et al. 2011	PCS	Yes	p <0.05	No	16.12	Beta	0.43 (N.R.), p=<0.001	Disability (ODI)	Catastrophizing thoughts predict disability, SES seems not to influence this effect
							Beta	0.31 (N.R.), p=0.004	Pain Intensity (NRS)	Catastrophizing thoughts predict pain intensity, SES has not influence on the effect
							Beta	0.1 (N.R.), p=0.35	Physical impairment (PIS)	Catastrophizing thoughts do not influence PIS
51	Du Bois et al. 2009	PCS: 3 subscales	Yes	p <0.05	No	N.R.	OR	N.R.	Sick leave more than 3 months	The three subscales of the PCS were univariate associated with the outcome but didn't remain in the multivariate model. TSK, PANAS, OMSQ single item remained prognostic in the multivariate model.
52	Burton 1995	CSQ	Yes	All	No	N.R.	Variance %	23%	Disability (RMQ)	Catastrophizing as a coping strategy explained 23% of the variance in the stepwise multiple regression.
							Variance for acute LBP	47%		In patients with acute LBP CSQ explained 47% of the variance
							LBP >3 to <52 weeks	0%		In subchronic patients CSQ did not explain variance in RMQ at one year.

Chronic Low Back Pain

ID	Study	Question-naire	MA?	Criteria for inclusion MA	Cut-off used	Base-line mean	Measure reported	Value (95%-CI)	Outcome	Prognostic?
1	Dozois et al., 1996	CSQ	Yes	N.R.	No	N.R.	Beta	-0.03 (N.R.)	Disability (ODI)	Non-prognostic: SCQ individual scores only accounted for additional 14% of variance in ODI-
			Yes				Beta	0.01 (N.R.)	Functional Status	Non-prognostic for functional status
			Yes				Beta	0.35 (N.R.), p=<0.0001	General Severity Index (SCL-90R)	Catastrophizing is the single predictor of GIS at follow-up+
			Disc. Func.				F-value	5.5 (N.R.), p=<0.05	Employment at 9 months	Individuals who were less likely to reinterpret pain sensations, catastrophize or ignore their pain were more likely to return to work
18 B	Grotle et al., 2010	CSQ	Yes	p < 0.1	No	N.R.	Beta	1.66 (0.68, 2.63), p=0.001	Disability due to LBP (RMQ)	Catastrophizing was associated with Disability at follow-up
8	Chibnall et al. 2009	PCS	Sequen tial M.R.	p < 0.05	0-29 vs. high ≥ 30	25.1	OR	N.R.	Pain Intensity (NRS)	High catastrophizing is not associated with pain intensity at follow-up
								N.R.	Disability (PDI)	High catastrophizing is not associated with disability
29	Mannion et al. 1999	Change in CSQ, score 0–2 for each	Yes	N.R,	N.R,	2	N.R.	N.R	Change in disability (RMQ)	Non-prognostic

		strategy used						N.R	Change in greatest pain (VAS)	23% of variance in change in greatest pain was explained by a reduction in disability, an increase in lumbar range of flexion, a decrease in the use of catastrophizing as coping strategy
								N.R	Change in average pain (average VAS 6 weeks)	Non-prognostic

Acute to Chronic Low Back Pain

ID	Study	Question-naire	MA?	Criteria for inclusion MA	Cut-off used	Base-line mean	Measure reported	Value (95%-CI)	Outcome	Prognostic?
13	Foster et al. 2010	CSQ	Yes	p <0.01	No	10	Beta	0.04 (0.02, 0.1), p=0.05	Disability (RMQ)	Non-prognostic
28 A	Linton et al., 2011	PCS	Yes	None	HiC >23, HiD >4	29.88	OR	3.97 (2.05, 7.72), p=<0.01	ADL dysfunction	Depression with (HiD + HiC) and without (HiD + LoC) high catastrophizing is associated with ADL dysfunction.
					LoC ≤23, HiD ≤4	15.12	OR	2.54 (1.54, 4.2), p=<0.01		Additional Catastrophizing with depression increases ADL dysfunction
					HiC >23 LoD ≤4	29.59	OR	1.18 (0.53, 2.6), p=0.69		High catastrophizing without depression was not associated with ADL dysfunction
25	Kovacs et al., 2012	CSQ	Yes	Predef. variables	≤ 8	15 (8.5)	OR	1 (Reference)	Reduction in Pain by ≥1.5 point in VAS	
					9-15			0.87 (0.58, 1.31), p=0.509		Non-prognostic

					16-20			0.66 (0.43, 1.01), p=0.056		Non-prognostic
					≥21			0.63 (0.39, 1.02), p=0.06		Tendency to less pain reduction but statistically not significant
					≤8			1 (Reference)	Reduction in RMQ of ≥ 3 points	
					9-15			0.87 (0.61, 1.23), p=0.428		Non-prognostic compared to the reference
					16-20			0.76 (0.51, 1.12), p=0.16		Non-prognostic
					≥21			0.64 (0.4, 0.96), p=0.029		Patients with high catastrophizing scores were less likely to have a CMID of RMQ.
12A	Dunn et al. 2011	CSQ	Yes	Adj.	No	N.R.	RR	1.46 (0.83, 2.54)	Severe disability LBP (CPG IV)	Non-prognostic for severe disability
12B	Hill et al.	CSQ	Yes	P <0.05	No	N.R	OR	7.63 (3.69, 15.7)	RMQ > than the median in the sample	Catastrophizing thoughts were associated with higher RMQ when compared to patients without catastrophizing thoughts.

Acute to Sub-Acute Low Back Pain

ID	Study	Design	Setting	Population	Diagnostic criteria	Disease duration: mean days (SD)	Power analysis	n (female)	Drop-out n (%)	Age (years) mean (SD)	follow-up (days)
18 A	Grotle et al., 2010 [40]	Prospective, SIGN +	5 General practices, North Staffordshire, U.K.	Population with 52% leg pain, 30% radiating below the knee	Definition proposed by de Vet et al., NSLBP	Acute/subacute LBP <3 months (Subgroup 1: 28%)	N.R.	258 (150)	141 (54.5)	46 (9)	360
19	Hiebert et al. 2012 [37]	Prospective, SIGN +	Washington Workers' Compensation Disability Risk Identification Study Cohort, U.S.A	Active military duty personnel, 3% radiculopathy, 92 % no radiculopathy	Classification by Spitzer et al., NSLBP + SLBP	<4 weeks: 136 (53%), 4-12 weeks: 102 (41%), not recorded: 15 (5%)	N.R.	253 (55)	15 (6)	32.3 (7.9)	90
14A	Turner et al. 2008	Prospective, SIGN ++	Washington Workers' Compensation Disability Risk Identification Study Cohort, U.S.A	Workers on sick leave and receiving replacement benefits	Acute SLBP / NSLBP	18 days after claim submission	1800	1885 (622)	12%	39.4 (11.2)	360

14B	Franklin et al. 2009 [34]	Prospective, SIGN ++	Same as Turner 2008	Workers with acute back injury, 42% opioid prescription at baseline, of those 30.4% had radiculopathy	Acute back injury causing work absence, NSLBP + SLBP	Median 18 days after claim filing (acute back injury)	N.R.	1843 (590)	737 (40)	39.4 (11.2)	360
37	Valencia et al. 2011 [46]	Secondary analysis of RCT, SIGN +	University of Florida affiliated orthopedic physical therapy clinics, U.S.A.	Patients participating in an RCT graded activity vs. graded exposure	Quebec Task Force on Spinal Disorders, SLBP + NSLBP	46.9 (33.6)	N.R.	108 (69)	36 (33)	37.2 (14.5)	180
51	Du Bois et al. 2009 [39]	Prospective SIGN +	Belgian compulsory health insurance system, Belgium	Workers with low back pain defined as pain located between the lower rib cage and the buttocks	NSLBP	After start sick-leave: 28-42. >84 days: 98 (28%)	N.R.	346 (163)	44 (11%)	41 (range 18-64)	90
52	Burton et al. 1995 [45]	Prospective SIGN +	Group practice of osteopaths in England (comparable to GP practices)	Consecutive patients for LBP	Not specified	<3 weeks 120 (486%), 3 to 52 weeks 102 (40%), >52 weeks 30 (12%)	N.R.	252 (121)	66 (26%)	42 (11)	360

Chronic Low Back Pain

ID	Study	Design	Setting	Population	Diagnostic criteria	Disease duration: mean days (SD)	Power analysis	n (female)	Drop-out n (%)	Age (years) mean (SD)	Follow-up (days)
1	Dozois et al., 1996 [38]	Prospective, SIGN +	Columbia Western Occupational Rehabilitation Center (WORC), Canada	Patients assessed for work hardening program; 86% mechanical LBP, 12% post-surgery, 2% fracture, 2% stenosis,	NSLB + SLBP	286.5 (86.4)	N.R.	159 (59)	32 (20)	39 (range 18-63)	270
18 B	Grotle et al., 2010 [40]	Prospective, SIGN +	5 General practices 8 GPs, North Staffordshire, U.K.	population with 52% leg pain, 30% radiating below the knee	Definition proposed by de Vet et al., NSLBP	Chronic LBP >3 months (subgroup 2, 78%)	N.R.	668 (396)	364 (54.5)	46 (9)	360
8	Chibnall et al. 2009 [43]	Prospective, SIGN ++	Missouri, First incident claimants, U.S.A.	All first time WC claimants	NSLBP + SLBP	636 (339)	N.R.	374 (150)	163 (43.5)	44 (10.8)	2160
29	Mannion et al. 1999 [47]	Analysis of an RCT, SIGN +	Local media advertisement, outpatient PT clinic, Switzerland	RCT physical therapy vs. muscle reconditioning vs. aerobics/stretching	NSLBP + SLBP	3924 (3372)	N.R.	137 (84)	15 (10.8)	45.1 (10.0)	180

Acute to Chronic Low Back Pain

ID	Study	Design	Setting	Population	Diagnostic criteria	Disease duration: mean days (SD)	Power analysis	n (female)	Drop-out n (%)	Age (years) mean (SD)	follow-up (days)
28	Linton et al., 2011 [42]	Secondary analysis of an RCT, SIGN +	PT-clinic, Australia, New Zealand	Patients participating in RCT exercises vs. advice	NSLBP	6-8 W: 121, 9-11 W: 22, 12 W: 39	N.R.	229 (109)	27 (12)	49.9 (15.8)	364
13	Foster et al. 2010 [51]	Prospective, SIGN +	8 General Practitioners in North Staffordshire, BeBack Cohort, U.K.	Patients visiting for LBP, in 41.1% leg pain, 24.5% pain referral above knee, 23.5% below knee	Morbidity codes indicating LBP (Read Code), NSLBP + SLBP	<1 month: 579 (38%), 1-6 months: 592 (39%), >7 months: 359 (24%)	N.R.	1591 (930)	780 (49)	43.9 (10.3)	180
25	Kovacs et al., 2012 [41]	Prospective, SIGN ++	GPs practicing in 14 health care centers, patients seeking care for LBP, Spain	Patients visiting for LBP, 24.1% disc protrusion, 6.4% spondylolisthesis, 8.3% spinal stenosis	NSLBP + SLBP	Acute 113 (7.9%), subacute 479 (33.7%), chronic 553 (38.9%), very chronic 277 (19.5%)	yes, n = 1500	1422 (890)	74 (5.2)	52.6 (15)	90
12A	Dunn et al. 2011 [31]	Prospective, SIGN ++	5 computerized General Practices in North Staffordshire, U.K.	Patients consulting with LBP, 66.3% leg pain, 42.4% distal leg pain, 73.5% upper body pain. 13.1% first episode	Morbidity codes indicating LBP (Read Code), NSLBP + SLBP	22% <3 months, 50% >1 year since the last pain free months	N.R.	389 (211)	195 (50)	46.7 (N.R.)	360

12B	Hill et al. 2008 [61]	Prospective, secondary analysis of Dunn	Same as Dunn	Same as Dunn	Same as Dunn	22% <3 months, 50% >1 year since the last pain free months	N.R.	410 (N.R.)	N.R.	N.R.	360

Conclusion: There is some evidence that catastrophizing as a coping strategy might lead to delayed recovery. The influence of catastrophizing in patients with low back pain is not fully established and should be further investigated. Of particular importance is the establishment of cut-off levels for identifying patients at risk.

Key words: Low back pain, back pain, catastrophizing, fear avoidance, fear avoidance beliefs, prognosis, prognostic factors

Introduction

Patients' attitudes and coping mechanisms seem to play a causal role in the chronification of low back pain (LBP). Almost all adults once in their lifetime complain about LBP, but 10-15 percent develop chronic LBP [1]. This small percentage of patients accounts for three-quarters of the costs of medical care and lost productivity associated with LBP [2, 3]. Consensus among experts recommend to avoid unnecessary investigation and overtreatment by treating symptomatically with encouragement to return to normal activity for treating patients with acute LBP [4]. Persisting pain for several weeks strongly predicts the development of chronic low back pain, a condition where complete recovery and return to 100% function are often difficult to achieve [5]. Current research aims to identify risk indicators for delayed recovery in patients with sub-acute LBP in order to optimize treatment to avoid chronification. Targeted and timely initiated interventions in patients at risk for chronic pain facilitate recovery and may reduce health care costs [6].

The Fear Avoidance Model (FAM) is a theoretical model that describes how psychological factors affect the experience of pain and the development of chronic pain and disability [7]. Within this theoretical concept catastrophizing is a "an exaggerated negative mental set brought to bear during actual or anticipated painful experience" [8]. It is theorized that negative beliefs about pain and/or negative illness information leads to a catastrophizing response in which patients imagine the worst possible outcome. This leads to fear of activity and avoidance that in turn causes disuse and resultant distress, reinforcing the original negative appraisal in a deleterious cycle [7]. The FAM suggests that patients without catastrophizing and fear avoidance beliefs (FAB) are more likely to confront pain problems and are more active in the coping process. This type of "good" coping has been used to develop interventions for those with catastrophizing and high FAB. In chronic cases,

catastrophizing may become a cognitive coping strategy based on the patient's characteristic coping style or because catastrophizing is believed to have prevented severe pain or other aversive outcomes in the past (22).

Although there is some empirical support for the FAM, it is a matter of debate as to how and when to best assess catastrophizing behavior in clinical practice. Current treatment guidelines for LBP recommend the timely identification and initiation of multidisciplinary treatment for other psychological factors (e.g. depression, distress, job dissatisfaction) associated with increased risk for delayed recovery [9-11]. Whether and how catastrophizing specifically should be assessed remains unclear. In a recent systematic review, we showed that FAB was prognostic in sub-acute LBP patients (XXX et al., submitted). Catastrophizing is believed to be a precursor for pain-related fear and FAB. It has been shown that patients can have FAB without catastrophizing [12] and it is unclear how catastrophizing as a coping strategy and FAB interact.

To date, the role of catastrophizing as prognostic factor for LBP has not been reviewed systematically. The aim of this systematic review is twofold. First, we review the existing literature on the role of a catastrophizing as a prognostic factor in acute, sub-acute, and chronic LBP. Second, we analyze the available data in terms of an optimal cut-off value for the scales used.

Methods

This systematic review follows the recommendation of the MOOSE statement (Figure 1) on conducting systematic reviews of observational studies [13].

Literature Search

We identified all observational studies meeting our eligibility criteria (defined in detail below) published between January 1980 and September 2012. The following databases were searched in September 2012: BIOSIS, CINAHL, Cochrane Library, Embase, OTSeeker, PeDRO, PsycInfo, Medline, Scopus, and Web of Science. The search was conducted with the help of an experienced librarian (M.G.). Search terms included various terms identified in the literature for catastrophizing (e.g. catastrophising, catastrophization, catastrophisation) subject headings and different combinations. Two detailed search strategies are depicted in Appendix 1. To ensure the completeness of the literature search, one reviewer (RE) conducted a hand search of the six most often retrieved journals (i.e. Pain, Sine, Journal of Pain, European Journal of Pain, Clinical Journal of Pain, Pain Medicine) and added all potentially eligible references not retrieved by the systematic search. Further the reviewers screened bibliographies of all included studies, retrieved review articles and current treatment guidelines in an additional hand. All potential relevant references to the research question were included in the full text review (inclusion and exclusion criteria applied).

Eligibility Criteria

All cohort studies were considered eligible for inclusion in this investigation that met the following criteria: they reported research concerning patients seeking care for NSLBP; they demonstrated at least moderate study quality; they investigated the prognostic value of catastrophizing; and they were published between January 1980 and September 2012. We

focused on cohort studies that included at least 300 subjects with a minimal follow-up of three months because of a concern about sample size. Assuming a baseline risk of 20% for chronicity following a bout of acute LBP [1], a sample size of 316 patients in a two-level exposure study (catastrophizing high vs. catastrophizing low) would generate a relative risk (RR) of 1.75 for the outcome recovery at three months [14].

However, inclusion of cohorts of more than 300 patients would have included almost exclusively cohorts with patients suffering from chronic LBP. To allow a comprehensive overview, we therefore also considered studies with 100 and more subjects and included prospective and retrospective cohorts as well as secondary analyses of RCTs. Excluded were studies with fewer than 100 patients, with follow-up of less than three months, or reports from conference proceedings. No limits for the study setting or language of the publication were applied.

Study Selection, Data Extraction and Synthesis

The bibliographic details of all retrieved articles were stored in an Endnote file. Two reviewers (MW and RE) independently screened all 706 references by title and abstract. The full text was reviewed by both reviewers independently (MW and RE) in all studies that met the pre-defined eligibility criteria (n = 77). Disagreements were discussed and resolved by consensus or by third party arbitration (SW). Alternative researchers with specific language proficiencies were used for non-English language references. In the event of several publications reporting about the same cohort without change in outcome or follow-up duration, the most recent publication was chosen and any missing information from the previous publication was added. The influence of catastrophizing and the results of the multivariate analyses were extracted with the help of an experienced statistician (UH).

Quality Assessment

The quality of each study was assessed using the Scottish Intercollegiate Guidelines Network (SIGN) Methodology checklist for cohort studies [15].

To assess the baseline characteristics of the study population, important prognostic factors for the course of LBP were extracted and assigned to the 16 domains proposed by Hayden et al. [16]. The following prognostic information was extracted [16, 17]: general characteristics, social environment, overall health status, overall psychological health, previous LBP, work-psychosocial demands, work-physical demands, work-history and attributes, disability-related to LBP, time change of LBP, physical examination findings, change in physical examination, diagnosis of LBP, and compensation related to LBP. Information about psychological domains measured was extracted.

Based on this information, the internal validity and the risk of bias of each study was rated independently by the two reviewers (MW and RE) according to the SIGN recommendation into high, moderate, or low quality. The ratings were:

- High quality (++): most of the criteria have been fulfilled. If not fulfilled, the conclusions of the study are very unlikely to alter.
- Moderate quality (+): some criteria fulfilled. Criteria not adequately described are unlikely to alter the conclusions.
- Low quality (-): few or no criteria fulfilled. The conclusions are likely to alter.

As recommended by SIGN, studies rated by both reviewers as low quality were excluded from further analysis.

Outcome Definition and Operationalization of Catastrophizing as a Prognostic Factor

All investigated outcomes were extracted and categorized into work-related (e.g. sick days, employment) and non-work-related outcomes (e.g. pain, perceived disability). Each method

of outcome measurement was appraised with regard to their validity and reliability and was operationalized [e.g. perceived disability measured by Oswestry Disability Index (ODI) or by Roland Morris Disability Questionnaire (RMQ)].

The term “prognostic factor” is used to describe factors that have a significant effect on outcome. “Prognostic” means that catastrophizing thoughts were significantly associated with outcome in a univariate analysis or in a stepwise procedure and therefore included in the final multiple model.

Psychometric Properties and Description of the Questionnaires Used

The Pain Catastrophizing Scale (PCS) [18, 19] consists of 13 questions. The total score is computed by summing responses to all 13 items (each item on a scale of 0-4, range 0–52). The higher the score, the more catastrophizing thoughts are present. A cut-off of more than (>) 30 points has been shown to be associated with clinical relevant influence. The internal consistency is high (Cronbach’s alpha 0.87 to 0.95) [19-21].

Three subscales are used and computed by summing the responses of the corresponding items: rumination (“I can’t stop thinking about how much it hurts:” sum of items 8, 9, 10, 11; range 0 – 16), magnification (“I worry that something serious may happen:” sum of items 6, 7, 13; range 0 – 12), and helplessness (“It’s awful and I feel that it overwhelms me:” sum of items 1, 2, 3, 4, 5, 12; range 0 – 24). The internal consistency is moderate to high (Cronbach’s alpha for rumination 0.87-0.95, magnification 0.66-0.88, and helplessness 0.78-0.91) [19, 21].

The Coping Strategies Questionnaire (CSQ) is a 48-item checklist in which subjects report the degree to which they utilize six cognitive and two behavioral coping strategies [22]. Two additional items relate to the subjective ability to control and decrease pain. Internal consistency and reliability in a LBP population was good in most sub-scales (Cronbach’s

alpha between 0.71 and 0.85) [22]. Six questions (item 5, 12, 14, 28, 38, 42) assess catastrophizing thoughts and negative self-statements, catastrophizing thoughts, and ideation. A sample question is "I worry all the time about whether it will end." The total score is computed by summing responses to the six items (each item is scored 0-6 points, range 0 to 36). The Cronbach's alpha of the catastrophizing subscale was between 0.78 [22] and 0.84 [23].

The Pain-Related Self-Statements Scale (PRSS) is intended to assess situation-specific cognitions that either promote or hinder attempts to cope with pain [24]. The PRSS consists of two nine-item subscales: "Catastrophizing" and "Coping." Catastrophizing is assessed with the items 2, 4, 7, 9, 10, 13, 14, 15, 16. Each item is scored on a six-point likert scale (0 to 5 points). The scale score is based on the average of all items (range 0 to 5) with the higher values indicating more catastrophizing. The catastrophizing subscale has been shown to be reliable and valid (Cronbach's alpha 0.83) [24].

The PCS and the CSQ are considered to be equally reliable and valid for the measurement of catastrophizing thoughts [25]. The advantage of the PCS is that additional dimensions of catastrophizing are measured. The CSQ, on the other hand, assesses catastrophizing unidimensionally but at the same time also measures other coping strategies. It has therefore been proposed to use the PCS in research that aims to explore catastrophizing [25]. The PCS and the CSQ have been compared in healthy volunteers [26]. In contrast to the hypothesis that PCS would be more strongly related to pain, no difference was found between the questionnaires. The PRSS is considered to be more pain-specific when compared to the CSQ. A direct comparison of the PRSS and the CSQ showed a good relationship between the two scales ($r = 0.56$) [24].

Statistical Analysis

Due to heterogeneous study populations, measurements and scales used as well as outcomes investigated, only descriptive statistics were used to summarize findings across all cohort studies for baseline catastrophizing mean values. We calculated mean number of reported domains within prognostic and non-prognostic categories. Forest plots were generated using the R statistical software for Windows (http://www.R-project.org/) [27]. Whenever possible, reported values (odds ratio, beta coefficient, or hazard ratio and corresponding 95% confidence interval) from multiple analyses were used in the forest plots.

Results

Study Selection

The search and inclusion process is summarized in Figure 1. Out of 1,473 records, 77 were reviewed in full text. The full text assessment utilizing the inclusion and exclusion criteria resulted in the exclusion of 58 studies. The main reasons for exclusion were: authors were not investigating catastrophizing as prognostic factor (n= 21); all musculoskeletal diseases were under investigation, without giving separate results for LBP (n= 13); less than 100 patients were included in the study reported (n= 15); and different study designs (e.g. cross-sectional, n= 9) were reported. In total, 19 publications based on 16 studies were included in the analysis.

Study Characteristics

Most studies were prospective cohort studies (n= 9), and five studies were secondary analyses of RCTs. Two publications [28, 29] were based on an RCT [30]. Four publications [31-34] were based on two cohort studies [35, 36]. All six publications investigated different outcomes and follow-up times and will therefore be included in the further analysis (n=18). The study quality was good in four studies (low risk of bias) and moderate in 12 studies due to incomplete description of the methodology (appendix 2). Most studies investigated perceived measurements (e.g. pain, disability) as outcome. Four studies investigated work-related outcomes (i.e. return to full duty in the military [37], employment [38], sick leave [39], and return to work (RTW) [33]).

Summary of Scales Used

In ten of 18 analyses, CSQ was used for assessing catastrophizing as coping strategy. In two reports, a single item question derived from the CSQ was used [31, 40]. Cut-off values

were only applied twice [medium 20-40, high >40 (on a standardized 0-100 scale) [29], low ≤8, low to medium 9-15, medium to high 16-20, and high ≥21] [41]. In eight analyses, catastrophizing was measured using the PCS. A PCS short version with three questions was used once ("I feel I can't stand it anymore," "It is awful and I feel that it overwhelms me," and "I keep thinking about how badly I want it to stop;" 0 "not at all" to 4 "greatly") [33]. One study investigated the prognostic value of the three sub-scales of the PCS (ramification, magnification, and helplessness) [39]. In three analyses, cut-off values in the PCS were used for defining high catastrophizing [high ≥23 [42], high ≥30 [43], low <2, moderate 2-<3, and high 3-4 (3 questions)] [34]. The catastrophizing subscale of the PRSS was used only once to measure catastrophizing thoughts [44].

Baseline characteristics are summarized in Table 1. In patients with acute LBP (disease duration of four weeks and less), three studies investigated the early prognostic value of catastrophizing thoughts at baseline on self-perceived symptoms at a follow-up between 90 to 360 days. Two separate analyses [28, 29] of a cluster RCT [30] comparing minimal intervention aimed as psychosocial factors (MIS) and usual GP care in the Netherlands are included. One analysis included all patients at a one year follow-up [28], and one only the patients who received UC treatment with a three month follow-up [29]. A second RCT conducted in the GP-setting in Australia compared acupuncture and Diclophenac to sham acupuncture and placebo [44]. One prospective cohort study followed patients for one year and investigated how catastrophizing thoughts were associated with prolonged bed rest.

Six studies (in seven publications) included patients with LBP duration of up to six months. Four prospective cohorts followed between 252 and 1,885 patients for three to 12 months. Two studies investigated work status [33, 37], one study sick leave [39] and two disability [40, 45] as the primary outcome. Based on a large cohort of patients with work-

related low back injury [33], long-term opioid consumption was also investigated [34]. One study was based on a RCT in a physical therapy (PT) setting and investigated self-perceived measures as outcome [46].

In patients with chronic LBP, three prospective cohort studies [38, 40, 43] and one secondary analysis of an RCT [47] were available including between 137 and 668 patients. Mainly self-perceived outcome measures were investigated. Follow-up was between six months [47] and six years [43]. Three cohort studies and one secondary analysis of an RCT in a PT setting in Australia investigated the prognostic value of catastrophizing in self-perceived outcome measures independent of the disease duration. A cohort study conducted in a GP setting in the U.K. [35] led to two publications investigating different outcomes [31, 32].

Prognostic Value of Catastrophizing in Patients with Acute LBP

Catastrophizing thoughts were prognostic for an unfavorable outcome [28] and prolonged bed rest [48] at one year (Table 2). Catastrophizing was also associated with less reduction in disability [29] and persisting symptoms [29] for patients at three months follow-up. Catastrophizing assessed with the PRSS was not found to be associated with days without pain [44]. In the secondary analysis of the RCT comparing minimal intervention strategy (MIS) and usual care (UC), catastrophizing thoughts predicted an unfavorable outcome. Upon further analysis of this RCT, evidence showed that patients with high fear avoidance beliefs (FAB) and patients with catastrophizing thoughts responded differently depending on the treatment received (results from MIS were better in patients with high FAB compared to results from UC, which were worse in patients with high catastrophizing) [49].

The Prognostic Value of Catastrophizing in Patients with Acute and Sub-Acute LBP

Patients using catastrophizing as a coping strategy expressed more pain and disability at six months [46] and more disability at one year than those who did not [40, 45]. Burton et al. conducted a subgroup analysis for patients with acute LBP (<3 weeks, n=56) compared to those with sub-acute LBP (3 weeks to <52 weeks, n=59). Catastrophizing in the acute group explained 47% of the variance in RMQ at one year, while it failed to explain any variance in the sub-chronic group. Catastrophizing was also associated with long-term opioid use at one year in the acute group [34]. No association was found between catastrophizing and work status [37] or sick-leave [39] at three months and with RTW after one year [33] in three studies. The secondary analysis of an RCT comparing the treatment-based classification (TBC) system, TBC and graded activity (GA), and TBC and graded exposure (GX) [50] addressed whether or not socioeconomic status influenced coping strategies. While socioeconomic status (SES) influenced FAB, catastrophizing remained an independent prognostic factor for disability and pain intensity at six months. In figure 2 the reported effect of catastrophizing in multivariate analyses in patients with LBP duration of up to six months are depicted.

The Prognostic Value of Catastrophizing in Patients with Chronic LBP

Catastrophizing thoughts were not associated with more pain or disability in patients with chronic LBP who had a first time claim for workers compensation in the U.S.A. [43]. In this study, patients suffered from LBP for an average of almost two years and they were followed for six years. Catastrophizing as a coping strategy was associated with more disability at nine months follow-up in patients participating in a work hardening program [38] and at 12 months in patients in the GP setting in the U.K. [40]. In both studies, patients suffered from LBP for a shorter period of time than in the study based on workers' compensation insurance data.

Among patients participating in a work hardening program in Canada, patients with catastrophizing thoughts were less likely to be employed at nine months.

The combination of a reduction in catastrophizing, a reduction in disability, and an increase in lumbar range of flexion explained 23% of the variance in greatest pain in a secondary analysis of an RCT [47]. In this study, a very chronic pain population was included with average disease duration of more than ten years. Catastrophizing was not associated with a decrease in average pain and disability.

Patients with Acute to Chronic LBP without Sub-Grouping

Two prospective cohort studies found catastrophizing thoughts to be associated with more disability at three months [41] and one year in a mixed group of patients [32]. In a large scale study in a GP setting in Spain, high catastrophizing (CSQ ≥21) was associated with less reduction in disability at three months. The patients included in this study were on average older when compared to the other studies (mean age 52.6 years compared to 43.9 and 46.7 years). Hill et al. [32] conducted a secondary analysis based on a study previously published [35] during the process of developing a screening tool (the STarT Back tool). They found catastrophizing thoughts to be associated with a poor outcome, defined in this case as a Roland Morris Questionnaire score above the median. The previously published analysis found no association between catastrophizing and severe disability (defined as Chronic Pain Grade IV) [31]. Catastrophizing thoughts increased the effect of depression in one study. High depression [median split in the depression anxiety stress scale (DASS) of ≥6] was associated with ADL dysfunction (activities of daily living, scale for chronic pain, score 0-40) at one year. High depression with high catastrophizing (PCS >23) increased the risk for ADL dysfunction significantly while high catastrophizing without depression was not associated with ADL dysfunction. In figure 3 the reported effect of catastrophizing in multivariate

analyses in patients with LBP of six months or more and studies with mixed disease duration are depicted.

Potential Influence of Important Prognostic Factors

The analysis of potential confounders for prognostic findings revealed that patients in prognostic studies were older (mean age 44 years, compared to 41 years: Table 3) and seemed to express higher levels of catastrophizing as coping strategy (Table 4: PCS mean 20 vs. 18; CSQ 12.3 vs. 10). The reporting of prognostic factors that potentially influence the course of LBP could be improved in all studies [16]. Out of the 16 possible prognostic domains, half of those known to influence the course of LBP were reported. Seldom reported were overall health status, work-related factors, time changes to the complaint and in the physical examination, and health care received. This finding potentially limits the generalizability of the studies.

In almost all study populations, little variability in catastrophizing was present with low mean baseline values (PCS between 11.2 and 29.9 on a 0-52 point scale, CSQ between 10 and 15 on a 0-36 point scale). The value of the sub-scales in the PCS and the established cut-off value in the CSQ for high catastrophizing (values of ≥30) were only used once. Studies with high baseline scores on a scale were more likely to find prognostic values for the scale. In studies that applied cut-off values, a dose-dependent likelihood for prognostic findings for catastrophizing (higher values associated with poorer outcome) [29, 33, 34] was present. An interaction between catastrophizing and depression in one study [42] was not present in other studies [40, 51].

Discussion

Main Findings

The synthesis of data from the included studies showed conflicting results about the association between catastrophizing and the future course of pain and disability in patients with low back pain. In studies that used cut-off values, high scores showed poorer outcome compared to lower scores, indicating that a "dose-dependent" effect of catastrophizing is present. Few studies used cut-off values and they varied greatly. Therefore, no cut-off can be recommended. Most patient populations investigated showed low baseline catastrophizing levels which might explain the non-prognostic findings. Studies with populations expressing higher mean catastrophizing levels at baseline were more likely to find catastrophizing to be prognostic for poor outcome. Of the few studies that investigated work-related outcomes, two out of four found that catastrophizing was not associated with work status. Studies that investigated self-report outcome measures found catastrophizing mainly to be associated with pain and disability in patients with acute, sub-acute, and chronic LBP.

Results in Light of Existing Literature

To our knowledge, this is the first systematic review summarizing the current evidence on the role of catastrophizing thoughts identified by commonly used questionnaires, as a prognostic factor in patients with acute, sub-acute, and chronic LBP. A systematic review investigated the importance of psychological factors in general, as predictors in 2002 [52]. Pincus et al. found weak support for the role of catastrophizing as a contributing factor for the development of chronicity in patients with LBP. At that time, only two studies using the CSQ for measuring catastrophizing as coping strategy were included in the analysis. In another

systematic review of the evidence for various psychological factors, catastrophizing was not found to be a prognostic factor [53].

Many non-systematic reviews have addressed the importance of psychological factors in the development of chronic pain [19, 54, 55]. The emphasis on catastrophizing was derived from cross-sectional studies that showed a correlation between high catastrophizing and high pain and disability. Further catastrophizing moderates effects of exposure in vivo in patients with pain-related fear [56]. Observational studies in patients with musculoskeletal pain showed that catastrophizing influenced recovery [57-59]. Sullivan et al. [57, 59] included in both studies workers with yellow flags and persisting pain after an injury. Bergbom et al. [58] investigated patients with musculoskeletal pain treated at PT clinics. In all three studies, patients expressed higher baseline catastrophizing scores (PCS between 36 and 51 compared to between 11 and 30 in the current analysis on a 0 to 52 point scale). Further, a relevant difference in baseline catastrophizing levels in patients that returned to work (PCS mean 20) to those who did not return to work (PCS 34) was found [57]. Based on the principle "the poison is the dose" it is reasonable to believe that this applies not only to catastrophizing but also to other psychological risk factors. One study that adopted a "dose-dependent" approach was the STarT Back study [32]. Patients at high risk for delayed recovery were identified by using a screening instrument that incorporates questions covering more than one psychological domain. This treatment approach facilitated recovery and reduced health care costs [6]. Our study supports this approach.

Strength and Limitations

The strengths of this systematic review are the assessment of catastrophizing in light of disease duration and the comprehensive evaluation of currently available studies. The search was inclusive, no language limitations were applied, and a thorough bibliographic search was

conducted in order to include all relevant studies. The extraction process was done in accordance with current guidelines and with the help of an experienced statistician. Potential sources of bias were identified by a multidisciplinary team (clinicians, statisticians, and methodologists).

The study's main limitation is a possibility of a publication bias due to unpublished negative findings. Studies that have investigated other psychological factors might have included catastrophizing in their analysis but did not report negative findings in the final publication. We have tried to balance this limitation by conducting a thorough bibliographic search of all included studies and therefore believe that most studies that investigated the influence of catastrophizing, even peripherally, have been identified. Many studies had moderate methodological quality and some did not meet the required sample size calculated for the primary outcome. For reliable subgroup analysis even more patients than the 300 patients required according to our sample size calculation for the primary outcome are needed [60]. The heterogeneity of the studies impeded us from conducting a meta-analysis.

Implications for Research

This systematic review highlights substantial gaps in the literature on the importance of catastrophizing for patients with LBP. Most evidence supporting the importance of catastrophizing are derived from in vivo and cross-sectional studies. Only a few cohort studies investigated the prognostic utility of the three scales used to assess catastrophizing thoughts in patients with acute, sub-acute, and chronic LBP for work-related and non-work-related outcomes. Based on the current analysis, it is unclear whether catastrophizing is a common response or coping strategy for individuals with LBP. On the other hand, there is no reason to believe this behavior should be more prevalent in patients with LBP compared to other pain

conditions. Research should aim at determining appropriate cut-off levels to identify patients at risk. Further, the subscales of the PCS, which assess three independent dimensions of catastrophizing (rumination, magnification and helplessness), were only investigated once. Further research should clarify the predictive value of the subscales. It might be that one dimension is more important than the others.

Valuable research might seek to increase our understanding of how catastrophizing as a cognitive response or a coping strategy interacts with fear avoidance beliefs (FAB). In the fear avoidance model, both the catastrophizing response and the resulting FAB are theorized to be important factors that promote the progression to chronic pain. In the current analysis, those studies that investigated both factors showed that in both, high baseline values influence outcome. A recent systematic review highlighted the importance of FAB in patients with sub-acute LBP (XXX et al., submitted). FAB were prognostic for poor work-related outcomes in most studies. In addition, high FAB reduce treatment efficacy in treatments based on a classical biomedical model while the effects of treatments addressing FAB were better (XXX et al., submitted). The current review of catastrophizing found insufficient studies that investigated catastrophizing and FAB. It is also unclear whether or not catastrophizing influences treatment efficacy or not.

Implication for Practice

To date, the value of screening for catastrophizing thoughts in patients with LBP has not been established. Cut-off values were seldom used and their predictive utility is unclear. Cut-off values are important for clinicians to identify patients at risk and to initiate targeted treatment. In a recent systematic review, we showed the importance of addressing FAB if

present (Wertli et al., submitted). Further, we showed that treatments addressing FAB are ineffective if no FAB are present. It is also unclear how catastrophizing thoughts interact with FAB and unclear if catastrophizing influences treatment response.

Conclusion

There is some evidence that catastrophizing as a cognitive response or ongoing coping strategy might lead to delayed recovery. The influence of catastrophizing in patients with LBP is not fully substantiated and should be investigated further. Of particular importance is the establishment of cut-off levels for identifying patients at risk.

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1 Figure 1: Study flow

Figure 2: Overview of catastrophizing as a prognostic factor in LBP of less than six months

Mean, mean baseline values reported in the studies; m/s, median split; Lo, low; Mo, moderate, Hi, high; FU, follow-up time in months; §, values of the univariate analysis (given to allow comparison)

Figure 3: Overview of catastrophizing as prognostic factor in studies including patients with LBP of six and more months

Mean, mean baseline values reported in the studies; m/s, median split; Lo, low; Mo, moderate, Hi, high; C, catastrophizing; D, depression; FU, follow-up time in months; §, values of the univariate analysis (given to allow comparison)

Table 1: Baseline Characteristics

SIGN, SIGN quality rating for cohort studies: (++), high quality: most of the criteria have been fulfilled. If not fulfilled, the conclusions of the study are very unlikely to alter. (+), moderate quality: some criteria fulfilled. Criteria not adequately described are unlikely to alter the conclusions; NSLBP, non-specific low back pain; SLBP, specific low back pain; LBP, low back pain; N.R., not reported; UC, usual care; MIS, minimal intervention addressing psychological risk factors.

Table 2: Results

Adj.: adjustment; N.R.: not reported; RR: relative risk; Unfavorable outcome, on a 7 point likert scale for recovery (“very much improved” to “very much worse”) slightly better or worse at ≥2 FU“; CPG Chronic pain grade Von Korff; RMQ: roland morris questionnaire; Ref: reference; VAS: visual analogue scale; MA?: Multivariate regression analysis performed: yes?; M.R., multiple regression analysis; Disc Fun, discriminant function analysis; PDI: Pain Disability Index; NRS: numeric rating scale; SCL-90R: Symptom, Checklist 90-Revised; ODI: Oswestry Disability Index; ADL: activity of daily living; PIS: physical impairment scale, Waddell et al.; Functional status, measured by 4 different maximal lifts (kg); Prolonged bed rest: >4 days, 1–4 days =short, Patrick et al, 1995; FU: follow-up

Table 3: Differences between prognostic and non-prognostic studies

Average of reported prognostic domains of studies in each category (acute, acute to subacute, chronic, acute to chronic)

Table 4: Summary of scales, baseline values and cut-off used

Of 13 studies (100%), 10 studies used the CSQ (53%) and 8 studies the PCS (42%) and 1 study used the PRSS (5%). Mean (SD), mean values and standard deviation were calculated based on reported mean baseline values.

Appendix 1: Search History for PubMed, CINAHL, PsychINFO October Week 2 2011

Ovid MEDLINE(R), Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid OLDMEDLINE(R) 1946 to Present

1 PsycINFO 1806 to October Week 2 2011

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Appendix 2: Internal Validity of Studies assessed using SIGN methodology Checklist [15]

WC, well covered; AA, adequately addressed; PA, poorly addressed; NA, not addressed; NR, not reported; N/A, not applicable

1.1, research question clear; 1.2, groups selected from a source comparable in all respects; 1.3 how many people asked to participate; 1.4, likelihood eligible subjects might have the outcome at enrolment; 1.6, comparison between full participants and lost to follow-up; 1.7, outcome clearly defined; 1.8, assessment of outcome blind; 1.9, when blinding was not possible, recognition that knowledge of exposure status could influence assessment; 1.10, measure of exposure reliable; 1.11, Evidence from other source that the method of outcome assessment is valid and reliable; 1.12, prognostic factor is assessed more than once; 1.13, main potential confounders are identified; 1.14, confidence intervals provided; 2.1: Risk of bias: (++), high quality: most of the criteria have been fulfilled. If not fulfilled, the conclusions of the study are very unlikely to alter. (+), moderate quality: some criteria fulfilled. Criteria not adequately described are unlikely to alter the conclusions. (-), low quality: few or no criteria fulfilled. The conclusions are likely to alter. 3.1 Funding: A, academic institution; H, healthcare industry; G, government; N, NGO; P, public funds; O, others; -, none

* items where the two reviewers resolved disagreement by consensus